Characteristics of

Chemical Weapons

True or False

1. Chemical warfare agents produce mass panic?

Answer

True: Without proper training, personnel panic, breathe deeper and inhale more agent. Also significant political impact (get our troops out!). With proper training we can survive and continue the mission.

True or False

2. Chemical warfare agents have never been

used, and the risk of future use is low?

Answer

FALSE:

- 423 BC Spartans - noxious smoke
- 1812 British - Sulfur Ships
- 1861 Civil War - Cyanide Bayonets
- 1915 German - Chlorine gas Attacks
- 1917 German - Mustard Gas
- 1985 Iraq, Halabja Village - Cyanide/Mustard
- 1995 Tokyo Subway - Sarin nerve agent

True or False

3. Chemical warfare agents are always deadly?

Answer

False: Throughout history Chemical warfare
agents have proved 5% fatal. Chemical
warfare agents do however inflict large
numbers of casualties causing a significant
logistical burden.

Question

4. What would be a good reason to use Chemical

warfare on your enemy?

Answer

Reasons:

- Demoralize will to fight?
  - Can’t see, smell, feel until too late?
- Obtain valuable real-estate (Airbase)?
- Make valuable equipment unusable?
- We have an antidote, they don’t?

Overview

- DEFINITION
- AVAILABILITY
- METHODS OF DELIVERY
- CHARACTERISTICS
- TYPES OF CHEMICAL WARFARE AGENTS AND THEIR EFFECTS

Definition

(IAW United Nations):

"...Chemical substances, whether gaseous, liquid, or solid, which might be employed because of their toxic effect on man, animals, or plants..."

Availability
Threat to U.S. Forces

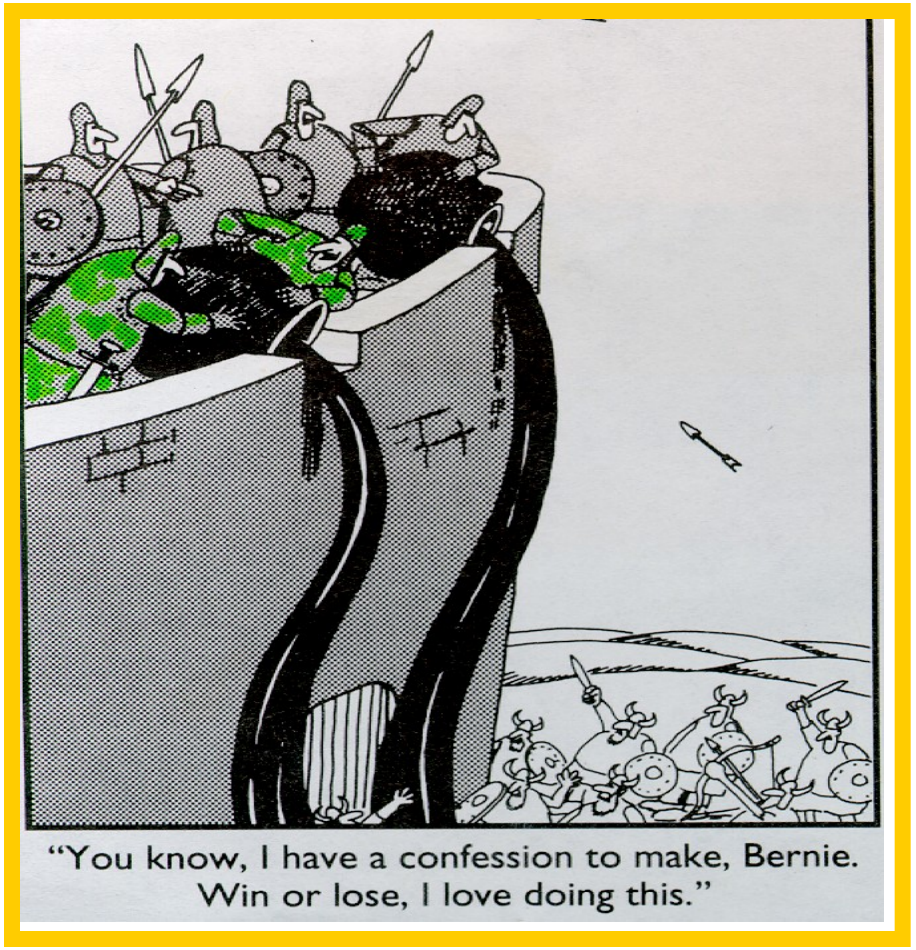
- Chemical weapons are readily available:
  - “22 Nations with confirmed CW programs”
  - “10 Additional nations showing interest”
  - Low cost
  - Limited technology needed to produce
- “The probability that US Forces will have to operate in chemical warfare environment has highly increased” (1996 DIA Report)

US POLICY

- No Use!
- We signed Chemical Weapons Convention (CWC) treaty on 13 Jan 93.
- 160 other nations also signed treaty
- Once ratified (summer 1996) nations have 10 years to destroy chemical munitions in an environmentally safe manner.

METHODS OF DELIVERY

- Explosive shells
- Rockets
- Missiles
- Bombs
- Mines
- Spray devices
- Contaminated Water and Food



CHARACTERISTICS

- State = Liquid, gas or solid
- Odor = None to highly pungent
- Persistence = Sticky liquid to light gas
- Vaporization = (ex: gasoline = high VP, OIL = low VP)
- Routes of entry = Respiratory, Dermal, Ingestion

TYPES OF CW AGENTS

- Pulmonary (Lung-damaging/Choking) Agents: Phosgene
- Cyanide (AC, CK)
- Vesicants: Mustard (H, HD), Lewisite(L) Phosgene Oxime
- Nerve: Tabun (GA), Sarin (GB), Soman (GD), VX
- Riot Control: Tear gas (CS), CN

PULMONARY AGENT EXAMPLES

- Phosgene (Organohalides)
  - Isocyanates
  - Carbon tetrachloride
  - Methylene chloride
  - Trichloroethylene

Pulmonary Agent Characteristics

- Colorless, heavier than air
- Considered non-persistent
- Odor of new-mown hay

Pulmonary Agent
Mode of Action

- Chemical damage to capillary walls in lungs
- Plasma leaks from circulatory system into pulmonary system
- Leads to "dry land drowning" (pulmonary edema)
- Slow action killers, 24 to 48 hours may pass between exposure and death.

Pulmonary Agent Signs/Symptoms

- Immediate: (10 minutes to 2 hours)
  - Eye irritation
  - Nose irritation
  - Throat irritation

Pulmonary Agent
Signs/Symptoms

- Delayed: (30 minutes to 24 hours)
  - Short of breath
  - Painful and productive cough.
  - Spasm of larynx (laryngospasm)
  - Acute Respiratory Distress Syndrome (ARDS)
  - Bluish color from lack of O_2 (Cyanosis)
  - Shock

Pulmonary Agent
First Aid/Decontamination

- Mask Yourself
- Decontamination not required if not liquid, aerate, move upwind
- Airway, Breathing, Circulation (ABCs)
- Enforced rest/observation minimum 4 hours
- Patient will "make or break" at 48 hours post exposure

CYANIDE

EXAMPLES

- Hydrogen cyanide (AC)
- Cyanogen chloride (CK)

Cyanide

Characteristics

- Very volatile vapor, lighter than air
- Considered non persistent
- Odor of bitter almonds
- Fast action killers, death within 6-8 minutes of high exposure.

Cyanide
Mode of Action

- Attaches to red blood cells
- Cells cannot utilize oxygen
- Cell dies
- Quickly affects heart's nerve conduction system, causing cardiac arrest.

Cyanide

Signs/Symptoms

- Light-headedness
- Hyperventilation
- Nausea/vomiting
- Pink skin
- Convulsions (15 seconds)
- Respiratory arrest (2-4 minutes)
- Cardiac arrest (4-8 minutes)

Cyanide
First Aid/Decontamination

- Mask
- No decontamination should be necessary, lighter than air, non persistent
- Remove patient upwind
- Amyl nitrite ampoule crushed under nose if available
- Immediate oxygen

VESICANT
EXAMPLES

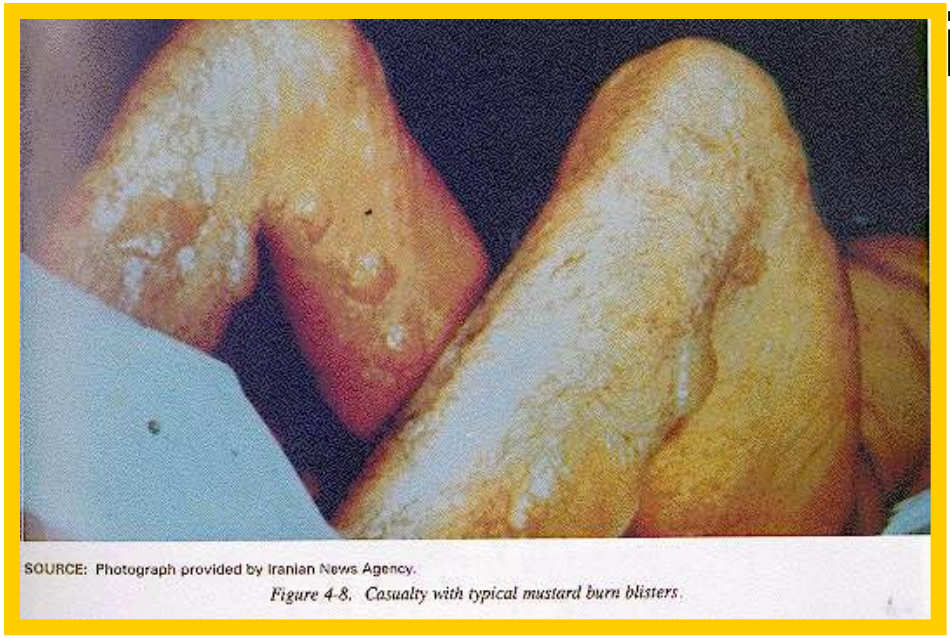
- Mustards: Sulfur (H,HD) - Nitrogen (HN)
- Lewisite (L)
- Phosge

Mustard
Characteristics

- Oily liquid, colorless to dark brown
- Smells like garlic, onions or mustard
- Vapor heavier than air and liquid heavier than water
- Considered persistent

Mustard
Mode of action

- Catastrophic DNA damage to the skin
- Destroys White Blood Cells and depresses ion of WBC's.

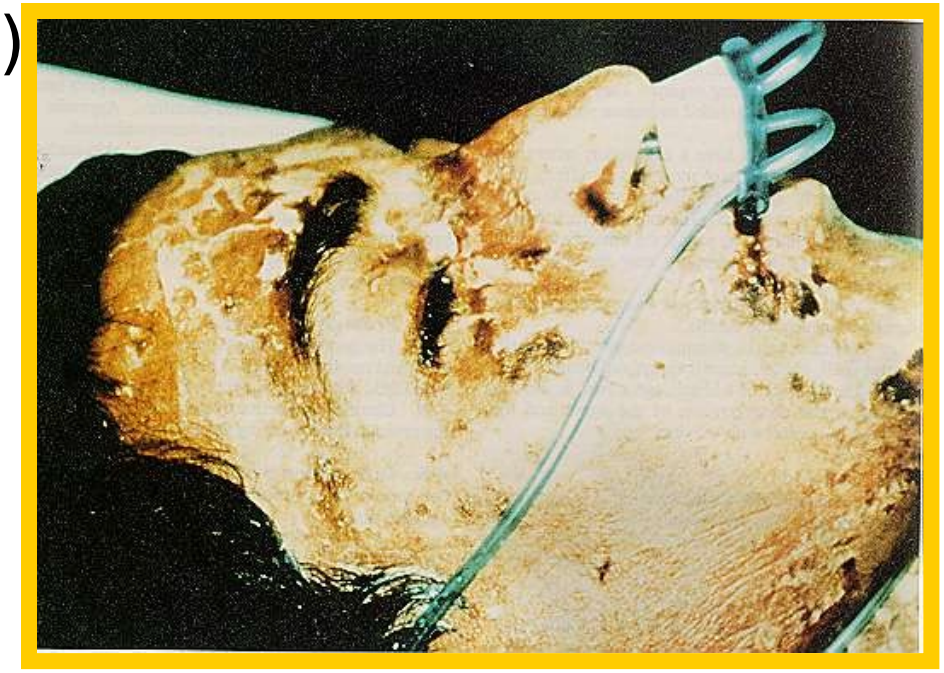


SOURCE: Photograph provided by Iranian News Agency.

Figure 4-8. Casualty with typical mustard burn blisters.

Mustard
Signs/Symptoms

- No pain on contact (most damage done in first 2 minutes)
- 30 minutes to hours = eyes: Itching, burning, lachrimation, photophobia, (sand in eyes sensation)



Mustard
Signs/Symptoms

- 2 - 24 hours = Reddening and blisters on the skin.
- 2-36 hours = Initial chest tightness, sneezing, hoarseness, cough.

SOURCE: Photograph provided by Iranian News Agency.

Figure 4-9. Casualty with severe blisters on the back.

Mustard
Signs/Symptoms

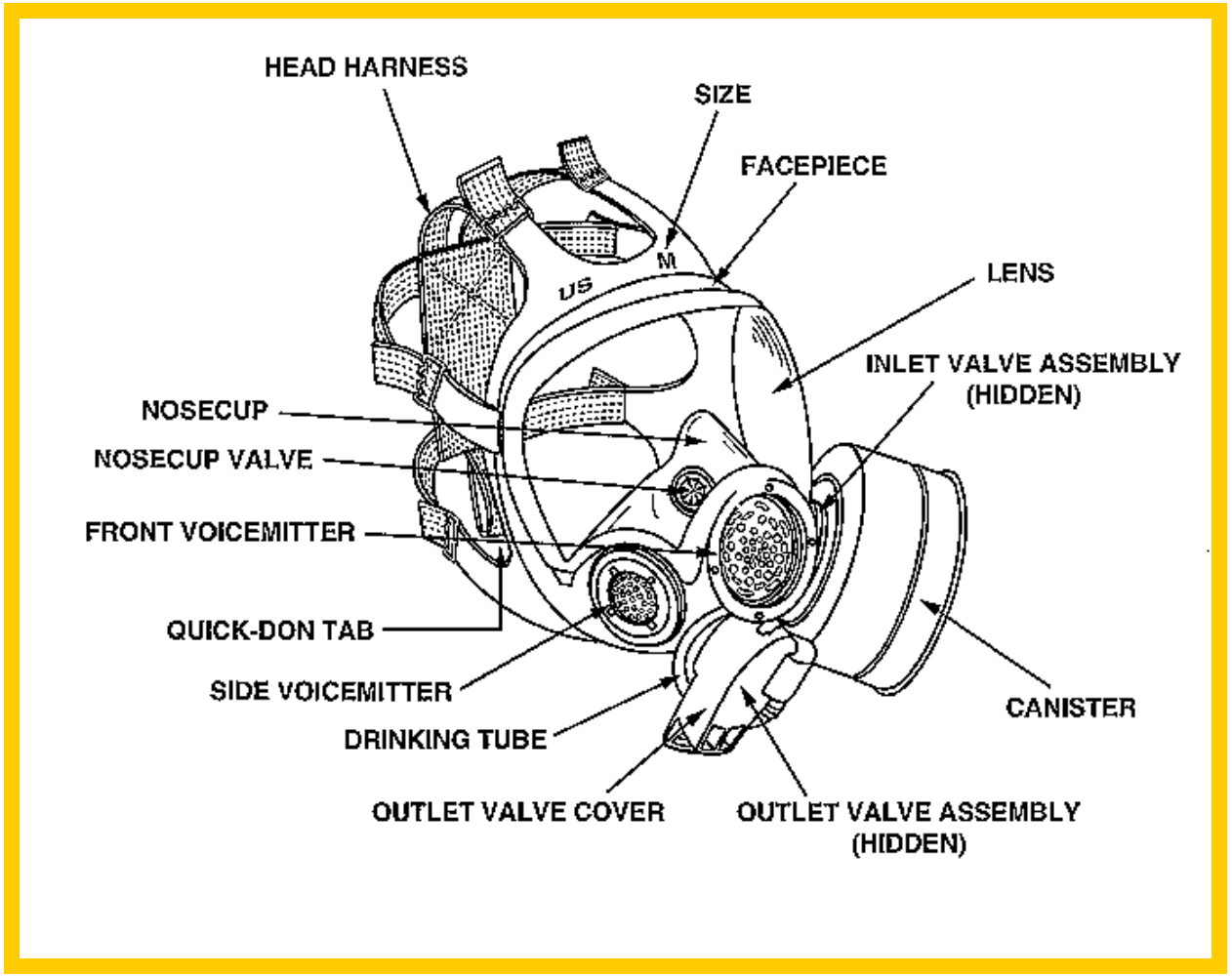
- Swelling and necrosis of airway mucosa, psuedomembrane formation, difficulty breathing, alveolar hemorrhage, bronchopneumonia

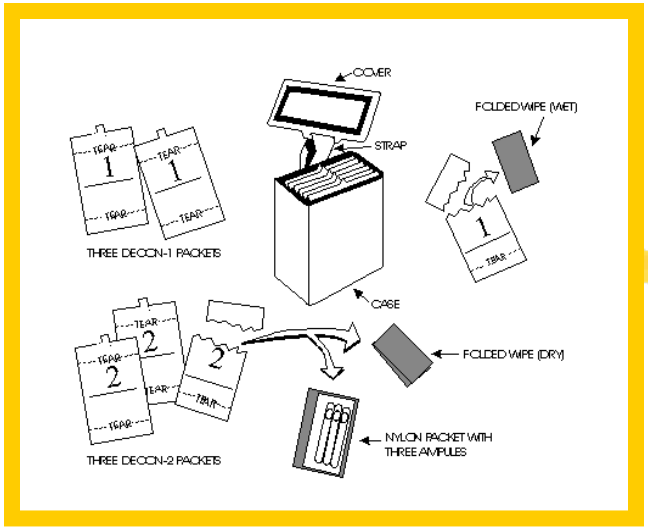
SOURCE: Photograph provided by Iranian News Agency.

Figure 4-11. Casualty with mustard burn on belt line and buttocks.

Mustard
First Aid/Decontamination

- **Mask**





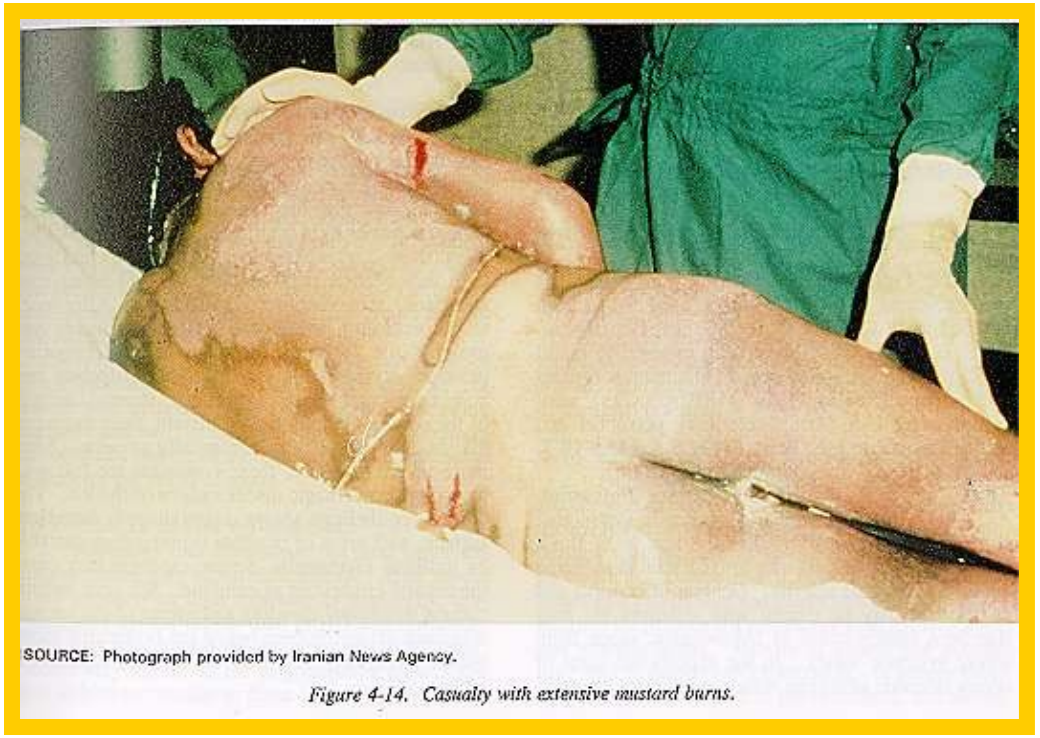
Mustard

First Aid/Decontamination

- **Decontamination (Immediate only way to prevent damage)**
  - **Eyes- Irrigation with water from canteen**
  - **Sodium-Hypochlorite (bleach) solution 0.5%**
  - **Skin- M258A1 Skin Decontamination Kit**
  - **NEW- M291 Skin Decontamination Kit**

Mustard
First Aid/Decontamination

- **Burns/Blistered treated as any other chemical burn**



SOURCE: Photograph provided by Iranian News Agency.

Figure 4-14. Casualty with extensive mustard burns.

NERVE AGENT
EXAMPLES

- Tabun(GA)
- Sarin(GB)
- Soman(GD)
- GF
- VX

Nerve Agent
Characteristics

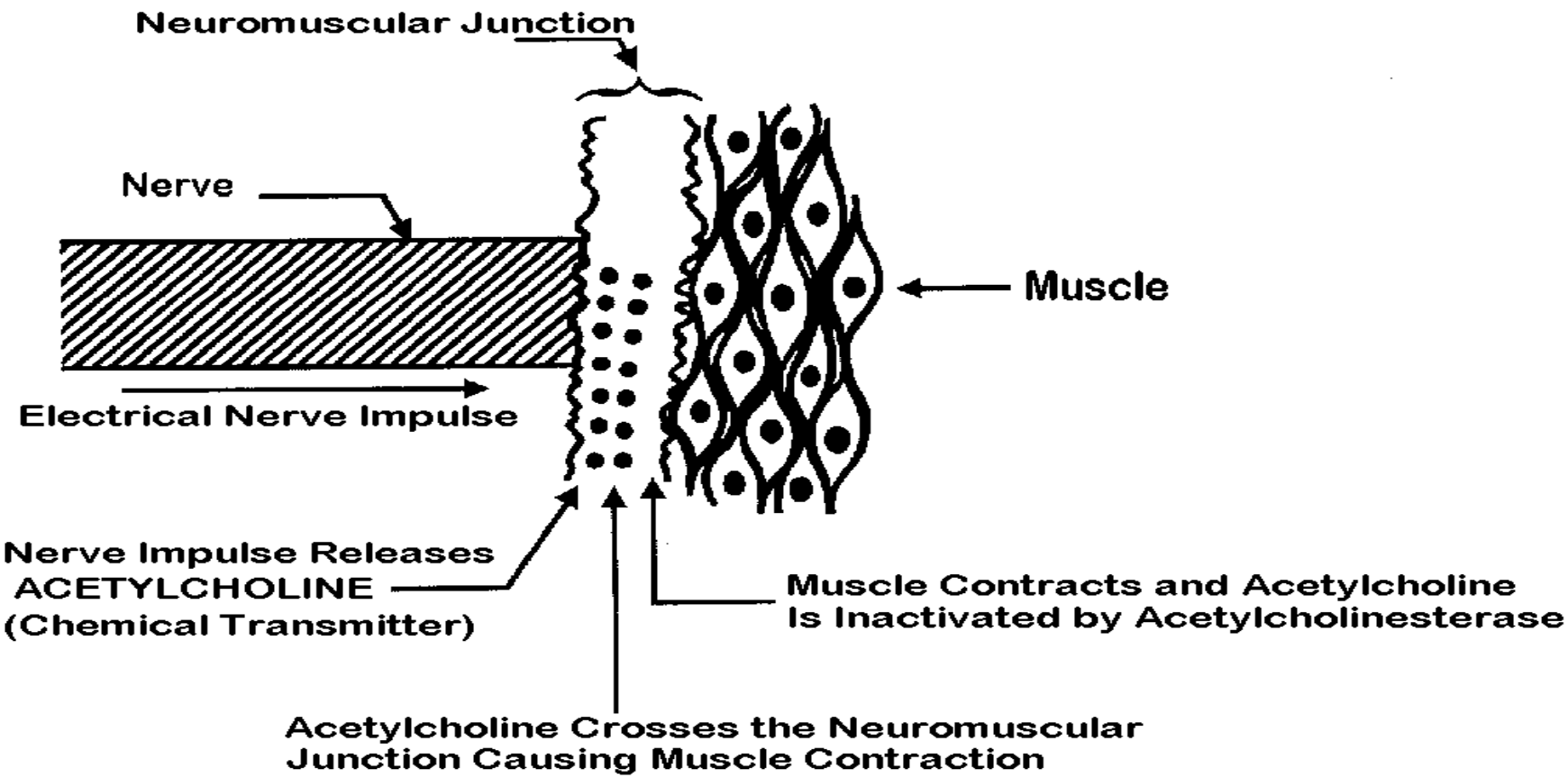
- Organophosphate compounds.
- Clear, colorless, odorless, tasteless liquids
- Penetrate skin and clothing very quickly
- Fast action killers (within minutes)
- Considered persistent, except for Sarin
- ***The most deadly of Chemical Agents!***

Nerve Agent

Mode of action

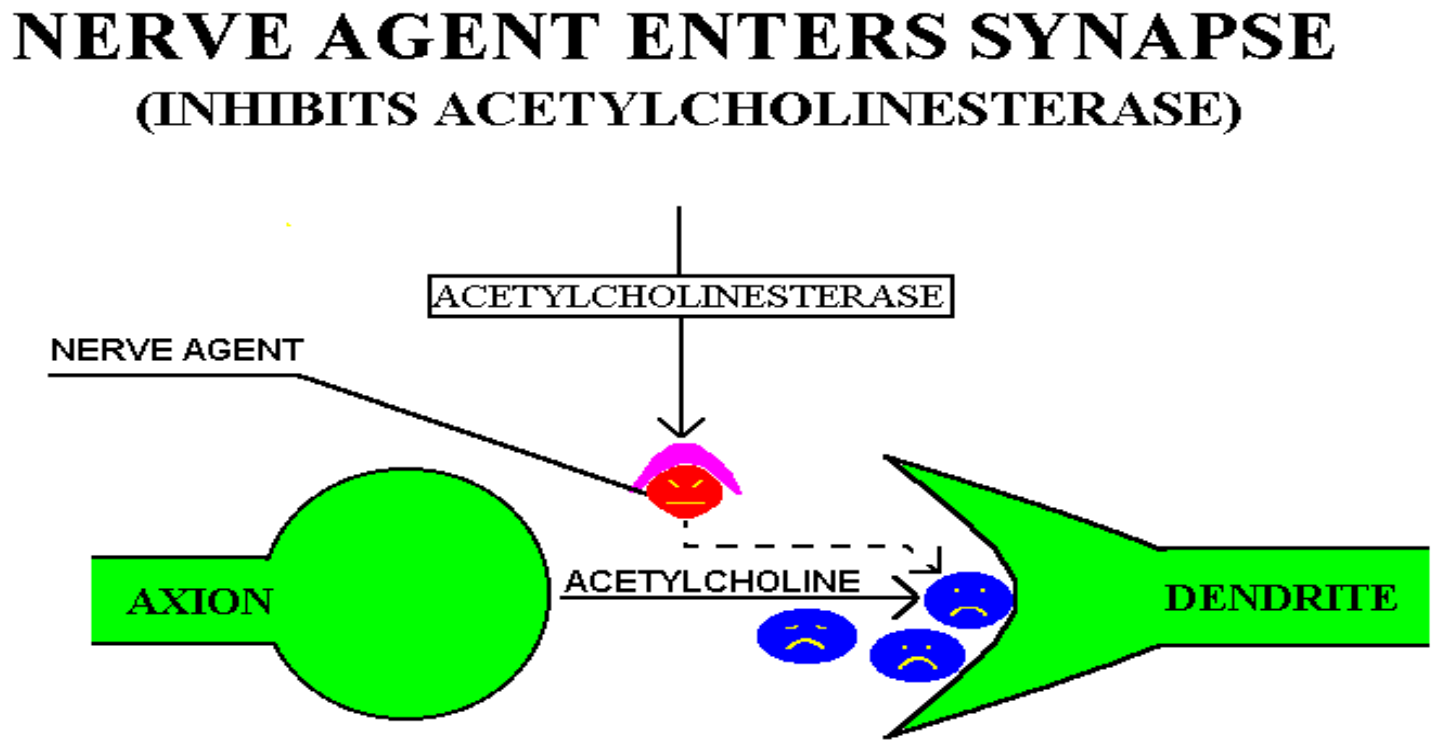
- Bind to acetylcholinesterase
- Inhibited acetylcholinesterase cannot hydrolyze acetylcholine
- Acetylcholine accumulates and causes biological effects
- Wow, what does that mean?...

Normal Synapse Function



Nerve Agent

Blocking Acetylcholinesterase



Nerve Agent
Signs/Symptoms - Vapor

- Immediate pin point pupils (miosis)
- Runny nose
- Tight chest, shortness of breath
- Loss of consciousness, convulsions, breathing stops, death

Nerve Agent

Signs/Symptoms - Liquid on Skin

- Onset several minutes to 18 hours
- Localized sweating
- Muscles twitching (fasciculation)
- Vomiting and diarrhea
- Loss of consciousness
- Convulsions

Nerve Agent
First Aid/Decontamination

- Immediate action
  - Mask
  - Decontamination
    - Eyes- Irrigation with water from canteen
    - Skin- Hypochlorite 0.5% solution
    - Skin- M258A1 Skin Decontamination Kit
    - NEW- M291 Skin Decontamination Kit

First Aid/Decontamination

- Pretreatment
  - Pyridostigmine bromide, issued under high threat conditions.
  - Protects some cholinesterase from being bound up by nerve agents. Has a short half life in the body, and is easily removed by the application of the drug 2 Pam chloride.

Nerve Agent Pyridostigmine Packet

- 21 tablets "blister pack".
- 1 tablet every 8 hours.
- If medical problems, check with senior medical officer.
- May change dose - 1/2 tablet every 6 hours.

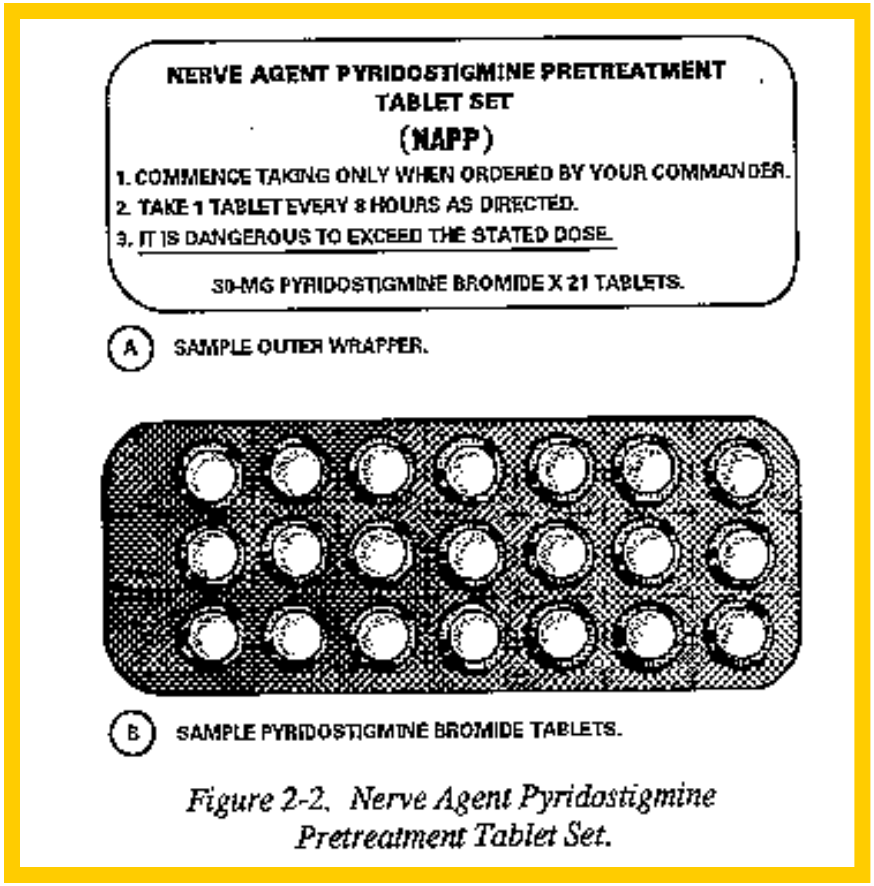
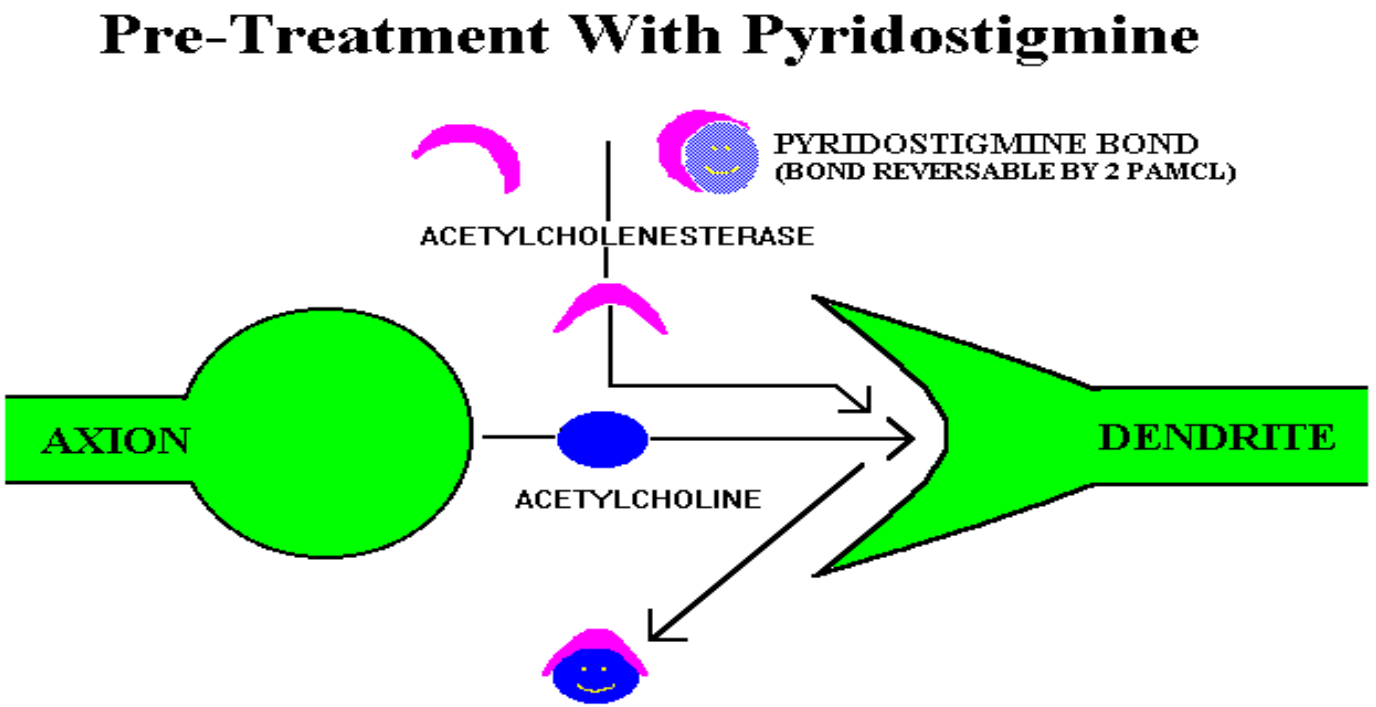

NERVE AGENT PYRIDOSTIGMINE PRETREATMENT
TABLET SET
(NAPP)
1. COMMENCE TAKING ONLY WHEN ORDERED BY YOUR COMMANDER.
2. TAKE 1 TABLET EVERY 8 HOURS AS DIRECTED.
3. IT IS DANGEROUS TO EXCEED THE STATED DOSE.
30-MG PYRIDOSTIGMINE BROMIDE X 21 TABLETS.
A SAMPLE OUTER WRAPPER.
B SAMPLE PYRIDOSTIGMINE BROMIDE TABLETS.

Figure 2-2. Nerve Agent Pyridostigmine Pretreatment Tablet Set.

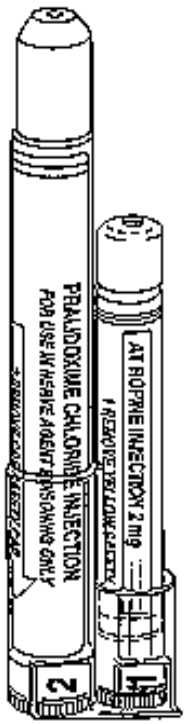
Nerve Agent

Effect of Pyridostigmine



Nerve Agent

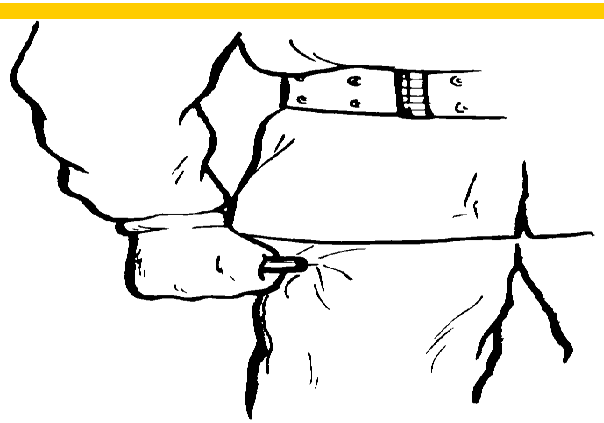
First Aid/Decontamination

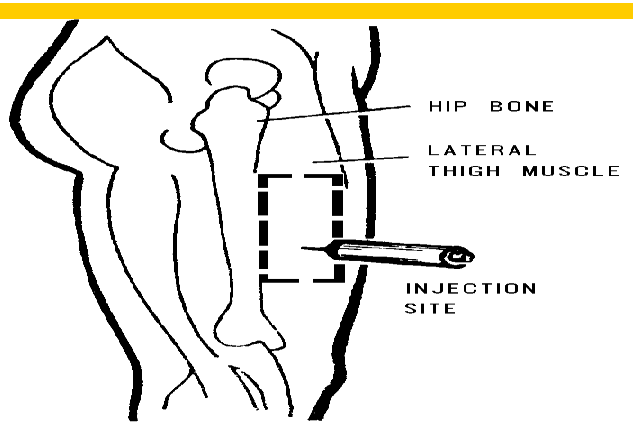


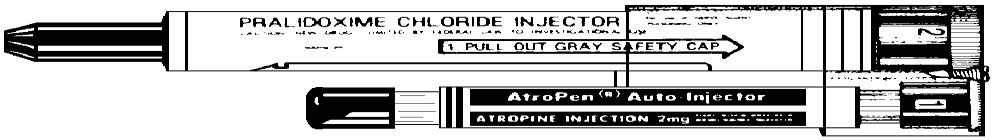
- If symptoms develop, inject 1 Mark I Nerve Agent Antidote Kit (Atropine and 2-PAM Chloride injector sets).
- Reevaluate after 10 minutes, if symptoms persist give 2 more Mark I sets.
- Give Mark I kits Until...
  - secretions are drying up
  - ventilations ease
  - Never more that 3 unless directed by a physician
- Each Individual Carries 3 Mark I’s

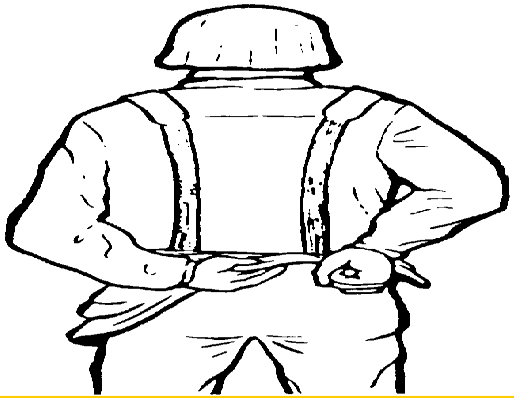
Nerve Agent

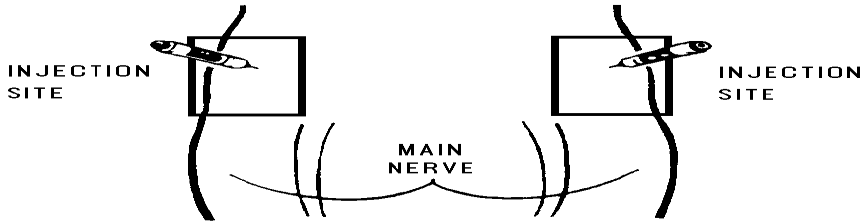
First Aid - Autoinjectors





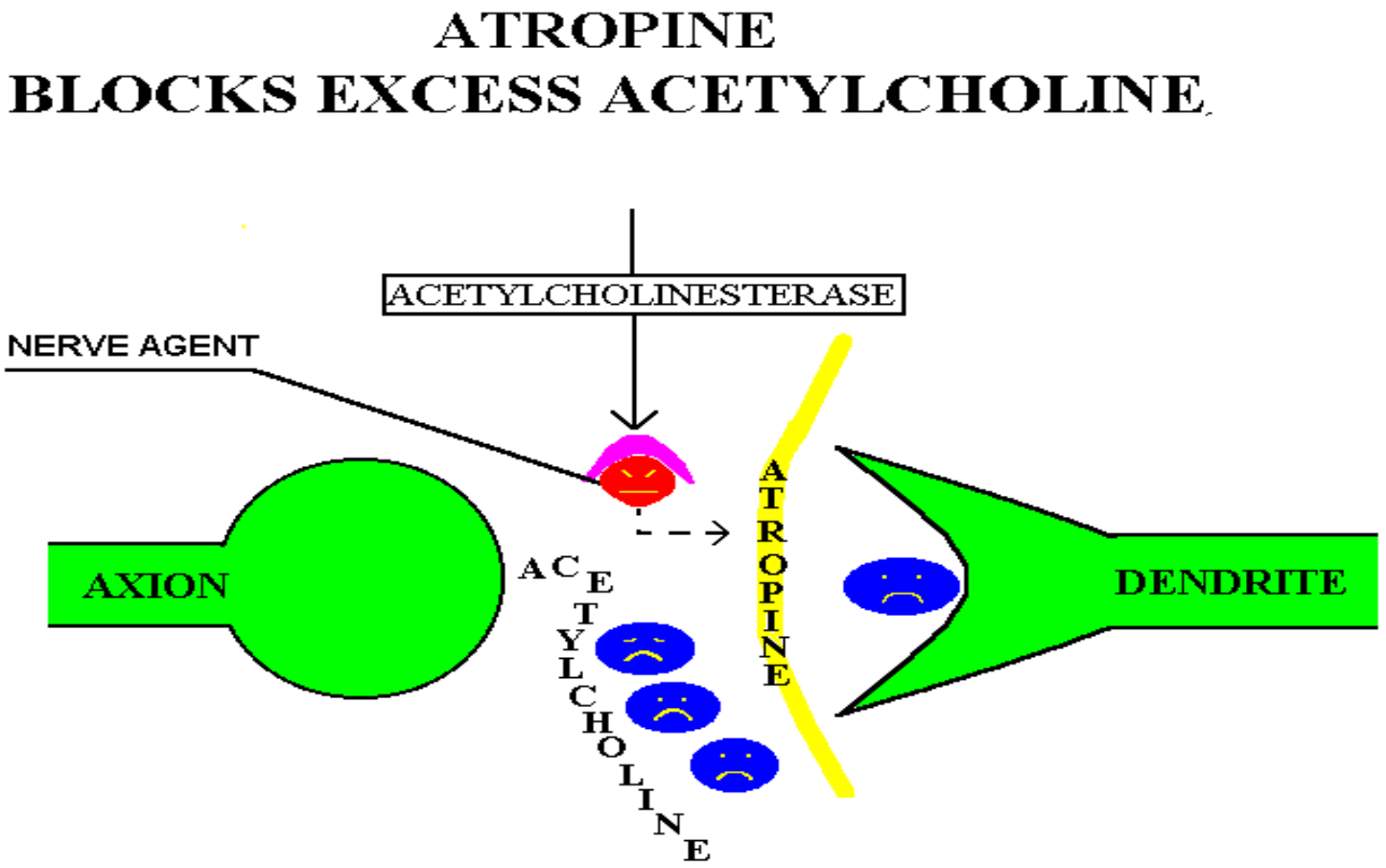






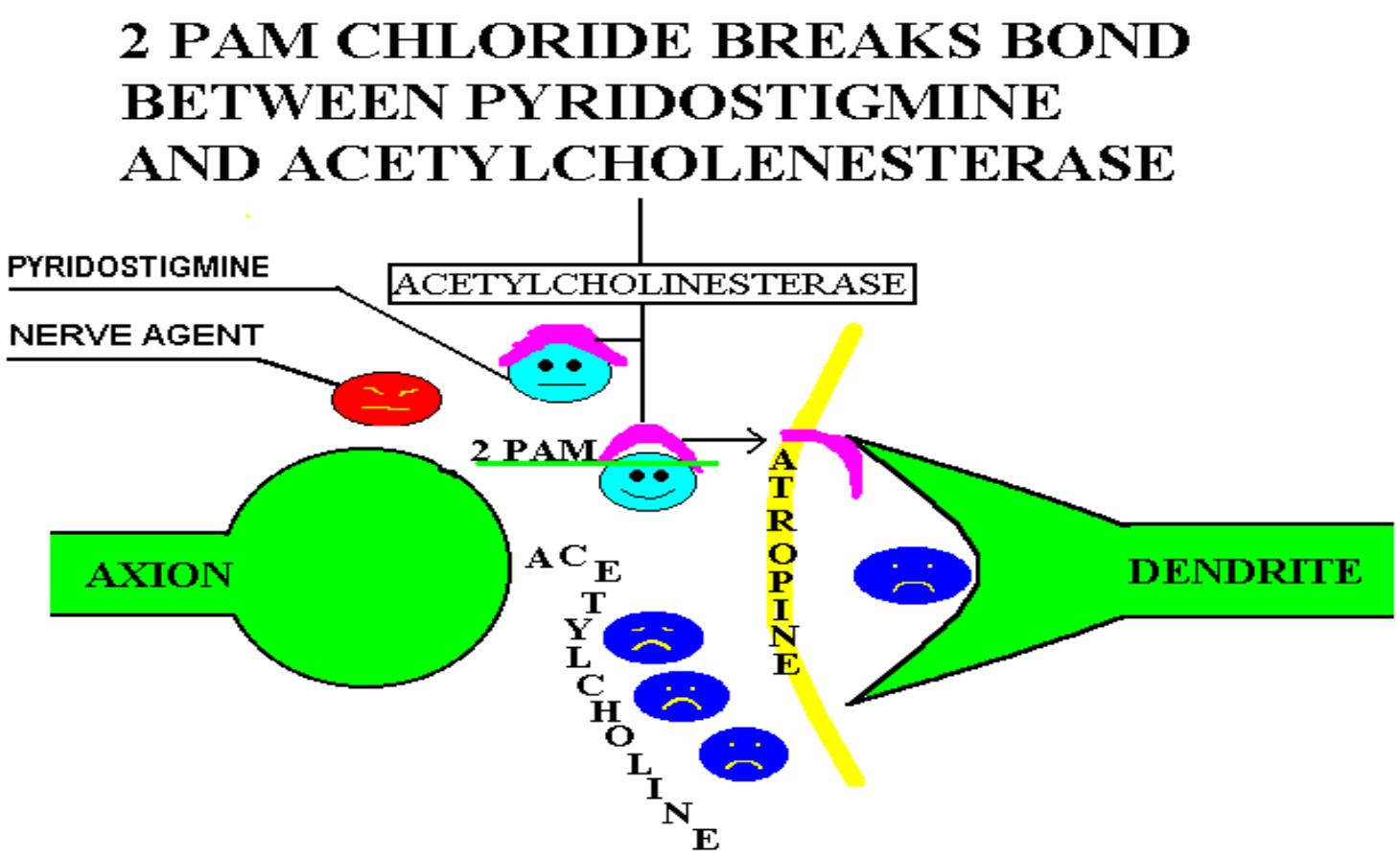
Nerve Agent

Effects of Atropine



Nerve Agent

Effects of 2 PAM Chloride



Nerve Agent
First Aid/Decontamination

- If all three Mark I sets are given, the NEW Convulsive Antidote Nerve Agent (CANA) (Diazepam) autoinjector is given by a buddy.

INCAPACITATING AGENTS

- Vomiting (DM, DA); may be combined with other CW agents to force mask removal.
- BZ
- Riot Control
  - Tear Gas (CS)
  - Maise (CN)

IMPACT ON MEDICAL SYSTEM

- Terror - psychological trauma.
- Overwhelming Numbers/High intensity care.
- Residual contamination/off gassing.

COMMON SENSE

- Detection
  - equipment (another lecture)
  - low flying aircraft
  - dead birds/animals
- Protection
- Avoidance
  - question clouds in low lying areas
  - select upwind position from enemy
- Decontamination (another lecture)

Characteristics of Chemical Weapons
Summary

- DEFINITION
- AVAILABILITY
- METHODS OF DELIVERY
- CHARACTERISTICS
- TYPES OF CHEMICAL WARFARE AGENTS AND THEIR EFFECTS